January 21, 1836.

RODERICK IMPEY MURCHISON, Esq., V.P., in the Chair.

George Biddell Airy, Esq., M.A., A.R.; George Budd, B.A. and M.A.; the Rev. Humphrey Lloyd, M.A.; the Rev. William Taylor; and Charles Wheatstone, Esq.; were elected Fellows of the Society.

Sir David Brewster's paper, entitled, "On the Anatomical and Optical Structure of the Crystalline Lenses of Animals, being the continuation of the paper published in the Philosophical Transactions for 1833," was resumed and concluded.

The author has examined the structure of the crystalline lens of the eye of a great variety of animals belonging to each of the four classes of Vertebrata; and has communicated in this paper a detailed account of his observations, arranged according as they relate to structures more and more complex. In a former paper, published in the Philosophical Transactions for 1833, the lens of the Cod fish was taken as the type of the simplest of these structures, in as much as all the fibres of which it is composed converge, like the meridians of a globe, to two opposite points, or poles, of a spheroid or lenticular solid; both of which poles are situated in the axis of vision. The structure which ranks next in respect of simplicity is that exhibited in the Salmon, among fishes; in the Gecko, among reptiles; and in the Hare, among Mammalia. It presents at each pole two septa placed in one continuous line, in different points of which all the fibres proceeding from the one surface to the other have their origin and termination. A structure somewhat more complex is met with in the lenses of most of the Mammalia, and is particularly exemplified in the lion, the tiger, the horse, and the ox. Three septa occur at each pole in the form of diverging lines inclined to one another at angles of 120°. The next degree of complexity is presented in the lens of the whale, the seal, and the bear, which contain, instead of three, four septa on each side, placed at right angles to each other in the form of a cross. In some specimens of lenses of whales and seals the author observed two septa from each pole, forming one continuous line, from each of the extremities of which proceeded two others, which were at right angles relatively to one another: so that there were in all five on each surface. The most complex structure is that of the lens of the elephant, which exhibits three primary septa diverging at equal angles from the pole, and at their extremities bifurcating into two additional septa, which are inclined to each other at angles of 60°, these latter being the real septa, to which the fibrous radiations are principally related. In some lenses of the elephant the author found the three septa immediately proceeding from the poles exceedingly short, and approaching to evanescence; so that he has no doubt that occasionally they may be found to have disappeared, and that the other six septa will then all diverge from the poles, like the radii of a hexagon, at angles of 60°.

In all the preceding cases, where the arrangement of the fibres is symmetrical on the two sides, the septa on the opposite surface

of the lens occupy positions which are reversed with respect to one another; thus in the simple case of the double septa at each pole, the line formed by those of the posterior surface is situated at right angles to that formed by the septa of the anterior surface. Where there are three divergent septa at each pole, the direction of those on the one side bisect the angles formed by those on the other side; and again, where the septa form a rectangular cross, those of one surface are inclined 45° to those of the other surface.

It follows as a consequence of this configuration of the series of points which constitute the origins and terminations of the fibres, that all the fibres, with the exception only of those proceeding in a direct line from the extremities of any of the septa, must, in their passage from the one surface to the other, follow a course more or less contorted; and must form lines of double curvature; that is, curves of which none of the portions lie in the same plane.

The fibres of the lenses of quadrupeds gradually diminish in size from the equator or margin of the lens, where they are largest, to their terminations in the anterior or posterior septa. They are united together by small teeth like those of fishes; but, generally speaking, the teeth are smaller and less distinctly pronounced, and sometimes they are not seen without great difficulty.

In the lens of the turtle, as well as in that of several fishes, the arrangement of the fibres, instead of being symmetrical on the two sides, as is the case in all the preceding instances, is different on the anterior and posterior surfaces; there being two septa on the former, but none in the latter, which presents only a single polar point of convergence.

The author has directed much of his attention to the optical properties of these structures. The lens of the salmon depolarizes three series of luminous sectors; the inner and outer series being negative, and the intermediate series positive. The polarizing structure of the cornea is negative, and it depolarizes very high tints at its junction with the sclerotic coat. When a slice cut from the sclerotica nearly perpendicularly to the surfaces, and with parallel faces, is exposed to polarized light, it exhibits the system of biaxal rectilineal fringes, exactly like those in a plate of glass heated by boiling water or oil, when in the act of rapid cooling. The same alternation of properties with regard to polarization in the successive strata of the substance of the crystalline lenses is exhibited by other fishes which the author examined.

With respect to the final cause of these highly complicated arrangements, it is reasonable to conceive that the gradually increasing density of the fibres in each successive stratum from the surface to the centre is intended to correct spherical aberration: but the design of the other properties resulting from the arrangement of the fibres with reference to septa, in all their variations of number and position, and more especially the alternations of positive and negative structures, as exhibited by the action of the different strata in polarized light, has not even excited the ingenuity of conjecture, and will probably remain among the numerous problems destined to exercise the sagacity of another age.